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## **Redistribution through taxes and deductions. A decomposition analysis with administrative tax data from Switzerland**

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# Redistribution through taxes and deductions

A decomposition analysis with administrative tax data from Switzerland

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## Abstract

This empirical analysis of administrative tax data from the Swiss Canton of Aargau (2001 to 2011), shows the potential that this type of data has to grant us a more complete picture of the redistributive effects of visible (tax rates) and hidden (tax deductions) instruments of the welfare state. In terms of methodology, Gini-based redistributive effects are decomposed into effects of mean tax rate, progression and reranking effects. The study's findings show a declined impact of direct taxes, which is attributable to reduced taxation on the community and cantonal but not the state level. At the same time, tax deductions drastically hamper the redistributive effect of taxes, primarily through deductions of wealth expenses, interest and extra-mandatory payments to the pension scheme, each of which leads to a substantial tax relief for high income earners.

**JEL:** D31, D6, H23, H24

**Key words:** Redistribution effects, direct taxes, tax deductions, tax competition, Switzerland

„There are good reasons why many scholars have recognized the importance of taxation. Taxes formalize our obligations to each other. They define the inequalities we accept and those that we collectively seek to redress. They signify who is a member of our political community, how wide we draw the circle of “we”. They set the boundaries of what our governments can do. In the modern world, taxation is the social contract”.

(Martin, Mehrotra, & Prasad, 2009:1)

# 1 Introduction

Redistributing economic resources is an important tool for the welfare state to reduce market inequalities. While classical economics assumes redistribution to be harmful to economic growth, e.g., by disincentivizing work and savings (Lazear & Rosen, 1981; Okun, 2015), newer studies question this view (OECD, 2008; Ostry, Berg, & Tsangarides, 2014) by demonstrating that inequality can also be harmful to growth, e.g., by undermining educational opportunities or personal health. Redistributing through social transfers can thus cause individuals with lower incomes to invest in their education and health (Galor & Moav, 2004). In this context, the OECD (2011; 2015) points out that the recent increase in inequality has not been caused by escalating markets but rather by a retreat of government. Therefore, it is important to study the effects of redistribution related to the welfare state. Redistribution occurs as part of social transfers and due to taxes. A common measure to study the redistributive effect of taxes is to compare pre-tax income distribution to post-tax distribution. The details of what happens, however, are usually not depicted. The degree of redistribution through taxes is usually attributed to the progression of tax rates, yet many countries also provide options for claiming deductions, which alter the redistributive effect of taxes (Howard, 1999; Titmuss, 1958). This latter aspect is often neglected since common survey data only reports the amount of taxes paid. Administrative tax data offers a good opportunity to analyze the visible (taxes) and hidden (deductions) instruments of the welfare state in detail, as it contains complete information of the tax assessment. Another advantage of this tax data is that it does not suffer from sampling bias, which is a common problem with analyses based on survey data; e.g., especially high incomes are appropriately covered. Tax data can therefore precisely depict pre-tax income distributions, which is not possible with other data sources (Hübelin & Farys, 2016).

The present study analyzes visible (taxes) and hidden (deductions) instruments of the welfare state by exemplarily using Swiss individual tax data from the Canton of Aargau from 2001 to 2011. This provides interesting opportunities to study the role of tax systems, as Switzerland is organized in a federal manner in which three entities levy taxes: state, cantons and communities. As the study is based on tax data, the actual tax system can be replicated, which permits us to evaluate all instruments of the fiscal welfare state (different taxes and deductions) with regard to their impact and effectiveness by creating counterfactual “what-if” scenarios. In these scenarios, different deductions are included or excluded and inequality measures before and after taxation are compared. The paper is structured as follows: Section 2 reviews literature regarding the redistributive effects of taxes. Section 3 gives an overview of the data being used, provides definitions of incomes, taxes, and deductions, and lays out the methodology used for effect decomposition. Section 4 reports results for the Canton of Aargau in 2001 and 2011, which consist of three parts. First, the impact of taxes is compared to the impact of social transfers (4.1). Second, redistributive effects of income and wealth taxes are quantified for the state, cantonal and community level, indicating a race to the bottom due to tax competition, which is most pronounced for communities (4.2). Third, how different tax deductions mitigate the redistributive effect of taxes is elaborated (4.3). Section 5, finally, discusses the findings and the implications for future research.

## 2 Redistribution through the tax system

Taxes and deductions can not only reduce but also intensify inequality. As long as taxes are designed *progressively*, they equalize disposable income. This means, the tax burden needs to increase over-proportionally for higher income brackets and filers. If taxes are skewed to place more of the burden on lower income brackets and filers then the tax system is *regressive*. Examples for the latter case are

lump-sum or poll taxes, which demand equal amounts of tax from all citizens. With regard to redistribution via income and wealth taxes, two mechanisms need to be distinguished. First, the design of the tax rate, i.e. its level and progressivity. Second, the deductions that are allowed to be made, which decrease the tax burden and therefore also increase disposable income. There have been several studies regarding the effect of progressive taxes, the results of which are summarized below. However, it is important to notice that these studies are static in their nature as they analyze the difference between income distributions including or excluding taxes or deductions. Such static analyses are therefore always incomplete since taxes can also have indirect effects that are caused by incentivizing certain behavior, which leads to a different pre-tax income distribution (e.g., optimizing employment level with respect to taxes). Studies which take behavior adaption into account are rare.<sup>1</sup>

## 2.1 The redistributive effect of taxes

All payments which are used to finance public goods are classified as taxes. The redistributive effect of taxes depends on the design.

- Measured by volume, the most important tax is the *direct tax on income*. Tax rates define which proportions of the market income are paid as taxes. The degree of redistribution depends on the mean tax rate and the progressivity. According to the OECD (2008), tax rates were lowered in most OECD countries in recent years. This tax relief was most pronounced for the highest incomes. At the same time, the top-income share increased (Matthews, 2011).
- taxes on wealth as well as taxes on income from wealth are assumed to decrease income inequality as wealth is more unequally distributed than income, so high net-worth individuals are taxed over-proportionally.

<sup>1</sup> Bargain et al. (2015), for example, present a new method to distinguish between direct policy effects and indirect effects by analyzing how individuals adapt to policies.

- *Deductions* indirectly contribute to redistribution by lowering the taxable amount of income. Whether they increase or decrease the inequality of disposable income depends on the specific design of the deduction possibilities and which income groups profit. Verbist & Figari (2013) showed that deductions reinforce tax progressivity, but the data this finding was based on was not suitable to distinguish different effects for each single deduction. Matsaganis & Flevotomou (2007), in contrast, showed that tax deductions concerning mortgage interest rates lead to increased inequality, because high income filers make these types of deductions more often and in a more financially significant way.
- Social security contributions, which are usually not designed to be progressive but flat as a percentage of market income, are another important kind of tax. Social security contributions lead to increased inequality because only market incomes are affected and wealth is not. In sum this leads to an over-proportional burden for lower income filers (Engler, 2011).
- Indirect taxes such as *consumption taxes* lead to increased inequality because lower income taxpayers need to spend over-proportional shares of their income on essential goods in comparison to those of higher income (Figari & Paulus, 2012). This effect cannot be depicted in most distributional studies because information on individual consumption is missing in the data.
- Studies often point out, that infrastructure that was financed by taxes (e.g., schools, hospitals, roads) has to be taken into account when doing distributional analyses. Yet most studies ignore this aspect, as it requires making strong assumptions about the individual utilization of this infrastructure. It can, however, be assumed that publicly financed infrastructure leads to an equalization of welfare. The OECD (2008) estimates the resultant reduction of inequality at 12.5% to 15%.

One key factor that affects the design of the tax system, and therefore its redistributive effect, is tax competition (Feld, 2000). A model frequently used to study tax competition is the Tiebout-Model

(Tiebout, 1956). The model describes two concurrent processes. Federal entities provide public goods which are financed by taxes. Citizens choose their place of residence according to their preferences concerning tax rates and amount of public goods. Resulting tax rates are understood as the market equilibrium that optimizes local individual preferences of taxation and public good provision.

Following the Tiebout-Model, Sinn (1997) brought to attention, that a decentral organization of the state can lead to problematical developments. First, those in high income brackets become harder to tax, as individuals can easily move to a neighboring community. Second, the provision of high amounts of public goods might attract low income groups, which pay too little in taxes to finance these goods. If these issues are ignored, tax competition might lead to segregation and a potential collapse of public budgets in some regions. Empirically, this fear is so far unfounded (Feld, 2000). The present study contributes to this discourse by testing the well-known “Race-to-the-bottom” thesis with a new data base. Following the Tiebout-Model, one hypothesis to test is that tax competition leads to a decrease in redistribution.

## **2.2 The effect of deductions: the hidden welfare state**

While the effects of taxes on the distribution of disposable incomes is well covered in the literature, the impact of deductions has seldom been studied because this information is usually not included in the data that is used. In general, tax deductions can be thought of as a form of welfare benefit (Howard, 1999). They can pursue social aims, such as when deductions for children or costs of illness or disability are granted. However, in many countries deductions exist that do not pursue aims of social policy and are available for all income classes. As tax relief leads to an increase in the disposable income of individuals while reducing the public budget, its nature is comparable to that of social transfers. While social transfers are a clearly visible and measurable result of a political process, the fiscal and general welfare effects brought about by deductions are difficult to trace and remain



hidden. In his pioneering essay „The social division of welfare“, Titmuss (1958) pointed out that the tax system takes on welfare state functions. He reminds us that when the tax system is not taken into account important developments are not recognizable. Titmuss is considered to be the founder of the fiscal welfare school, which is committed to analyzing the significance of the tax system as a “hidden welfare state” and has gained in importance in recent years (Morel, Zemmour, & Touzet, 2016).

A reduction of taxes can occur in several different forms. The OECD (2010) distinguishes between different kinds of tax relief:

- *Tax deductions*: These comprise amounts that are deductible from taxable income, which accordingly lead to a lower tax rate and tax burden. While some deductions relate to certain expenses (e.g., interest costs), standard deductions are granted based on predefined situations (e.g., child deductions).
- *Tax exemption*: One possibility is to exclude incomes from taxation if they fall below a certain threshold. As part of a poverty policy, e.g., incomes below the poverty line could be exempted. Another is to exclude certain sources of income from taxation, such as means-tested social transfers.
- *Privileged tax rates*: Authorities also have the option to apply different tax rates for different situations (one example being tax privileges for single parents).
- *Tax credit*: Deductions are based on the taxable income and therefore the actual amount of tax paid depends on the amount of income. Tax credits, on the other hand, lead to a direct reduction of tax burden. Tax credits are one efficient tool to reduce inequality because they can be used in a targeted manner.

Regarding tax deductions one must bear in mind that their effect on inequality is not direct but indirect. Deductions alter taxable income and tax rates, but the actual effect on the after-tax income

distribution is complex and depends on the particular constellation. Theoretically, three situations can be distinguished:

- *Deductions are made equally across all income groups.* As tax rates are usually progressive, a flat deduction, however, over-proportionally favors high income filers, thus leading to an increase in inequality.
- *Deductions are more frequently used by high income filers.* Therefore, higher income taxpayers profit more and an increase in inequality is to be expected.
- *Deductions are over-proportionally used by lower income filers.* In this situation, inequality can decrease if the tax relief effect outweighs the effect of lowered tax rates.

In summary, redistribution effects are highly dependent on the specific design of the tax and deduction system as well as the actual income distribution, emphasizing the need for empirical studies.

In the following analysis of individual tax data the Canton of Aargau will be used as an example to show the role taxes play in redistribution in Switzerland. The analysis includes how the effects of taxes on different federal levels changed over time (2001 to 2011). Following the analyses of tax effects, we study the impact of different deductions on the after-tax income distribution, focusing on the widespread and important deductions. While the Swiss system also makes use of tax exemptions (e.g., for social assistance) and preferred tax rates (e.g., single parents), these instruments will not be discussed.

### 3 Data and methods

#### 3.1 Using tax data for inequality studies– The case of the Swiss tax system

Switzerland is one of very few countries using a decentralized tax system. Income taxes are levied on three levels: by state, canton and community. Consequently, numerous micro tax regimes exist. For the present study, the tax data used was collected within the research project “Inequalities of incomes and wealth in Switzerland”<sup>2</sup>. Cantonal tax data has the advantage of including comprehensive information on the financial situation of all citizens of a region, thus not suffering from sampling biases. Information on the tax assessment is additionally included, which allows different income components (such as pre- and post-tax incomes) that are needed for the analysis to be calculated. However, not all cantonal tax data is available. Some cantons rule out the use of tax data for research purposes for privacy reasons. Furthermore, historical tax data has only been archived in a few cantons. The present study therefore uses tax data from the Canton of Aargau, where detailed data is available from 2001 to 2011. Aargau is the fourth-largest canton of Switzerland with 273,580 tax units in 2001 and 327,047 in 2011. With respect to economic inequality and mean income, Aargau is very close to the Swiss median. It can therefore cautiously be assumed, that results based on the Canton of Aargau give a good approximation of the average situation across Switzerland. An important drawback of using tax data that should be noted is that tax data is not based on real households but on the tax units that are subject to the tax assessment, which leads to an overestimation of inequality (Hümbelin & Farys, 2016)<sup>3</sup>. Furthermore, means-tested transfers are not taxed and thus not available for inclusion in the analysis.

<sup>2</sup> See the project website <http://Inequalities.ch> for further details.

<sup>3</sup> There are multiple situations in which one household hands in more than one tax declaration, although all household members live off the income that was jointly earned. One example are young adults living with either their families or

### 3.2 Definition of incomes, taxes and deductions

According to the federal structure of Switzerland, taxes are levied at three levels (state, canton, community). In addition, there is a church tax (for a graphical overview see Figure 2 in the appendix; the figure also shows the tax assessment for direct taxes on incomes in a simplified way). However, cantons, communities and church also levy taxes on wealth. Taxes are based on gross income, which includes all earned income<sup>4</sup>, capital income and taxable social transfers. Before taxation, several different deductions can be made<sup>5</sup>, resulting in the taxable income. Based on the taxable income either the cantonal or state level tax rate is applied. To calculate the actual canton, community and church taxes, the tax determined based on the cantonal tax rate is multiplied by a factor which communities and cantons can choose for the simplified short-term management of their tax revenue to avoid the more complex legal process of adjusting the rates.

Table 1 shows that more than two thirds of the tax burden is carried by canton and community tax, while the state tax level has a much lower volume and church tax is relatively minor. In comparison to 2001 it can be seen that canton and community tax slightly lost their significance in the subsequent decade while state level taxes gained importance. This can be attributed to two cantonal tax reforms which were issued in the Canton of Aargau between 2001 and 2011. These included comprehensive tax reliefs, which over-proportionally favored high income filers (see Table 6 and Table 7 in the appendix). Both reforms can be perceived as reactions to the tax competition; they sought to increase the attractiveness of the canton, especially for high earners.<sup>6</sup> In accordance with the reforms, the actual tax burden shrunk from 13.4% to 12.4%, as seen in the table. At the same time, the tax

together with their unmarried partner. When these constellations are ignored, many households are mistakenly assumed to be low income although they have more resources at their disposal.

<sup>4</sup> Social security contributions are already deducted from earned income.

<sup>5</sup> The data only include deductions possible for the canton. For the state tax, deductions can differ slightly.

<sup>6</sup> Apart from that, Aargau was not amongst the cantons that were aggressively competing.

revenue, driven by a higher number of tax units, increased. Furthermore, the population was, on average, richer in 2011 than in 2001. Section 4 discusses which redistribution effects are associated with this change.

Table 1: Tax revenues and burdens for the Canton of Aargau by federal level, 2001 und 2011

Tax year		Total (CHF million)	% of taxes	% of total gross incomes
<b>2001</b>	Income tax (state)	534.5	15.7	2.1
	Income tax (canton)	1241.2	36.5	4.9
	Wealth tax (canton)	129.8	3.8	0.5
	Income tax (community)	1186.4	34.9	4.7
	Wealth tax (community)	122.6	3.6	0.5
	Church tax	185.5	5.5	0.7
	<i>All taxes</i>	<i>3400.0</i>	<i>100.0</i>	<i>13.4</i>
<b>2011</b>	Income tax (state)	645.0	17.0	2.1
	Income tax (canton)	1406.4	37.0	4.6
	Wealth tax (canton)	135.1	3.6	0.4
	Income tax (community)	1311.7	34.5	4.3
	Wealth tax (community)	124.2	3.3	0.4
	Church tax	178.0	4.7	0.6
	<i>All taxes</i>	<i>3800.3</i>	<i>100.0</i>	<i>12.4</i>

Note: Tax data of the Canton of Aargau, authors' calculations. The tax sums for 2001 are inflation adjusted based on the Swiss consumer price index (2001:92.4, 2011:100)

Like all Swiss cantons, Aargau allows for several tax deductions to be made. While the specific design of the deductions varies slightly between cantons, most models are still very similar. For the present analyses, the numerous deductions have been classified into six categories (see Table 8 in the appendix). *Social deductions* consist of deductions that are related to the family and health situation (second earner deduction, child deductions, health care costs, etc.). *Work-related expenses* include miscellaneous necessary costs related to employment, like travel expenses, weekly stays and training costs. Expenses relating to real estate like maintenance and interest costs are classified as *real estate and interest costs*. Further deductions are extra-mandatory payments to the pension scheme as well

as costs of asset management and insurance costs (*Deductions related to assets and insurance*).

Finally, alimonies to partners and donations can be deducted (*Alimonies and charity*). All other

deductions are classified as *other deductions*.

Table 2: Tax deductions, Canton of Aargau, 2001 and 2011

Tax year		Total (CHF million)	% of all deductions	% of total gross incomes
2001	A Social deductions	1087.3	15.1	4.3
	B Work-related expenses	1756.9	24.4	6.9
	C Real estate and interest cost	2603.1	36.1	10.2
	D Deductions related to assets and insurance	1527.1	21.2	6.0
	E Alimonies and charity	216.1	3.0	0.8
	F Other deductions	10.7	0.1	0.0
	<i>All deductions</i>	<i>7201.2</i>	<i>100.0</i>	<i>28.2</i>
2011	A Social deductions	1144.1	13.7	3.7
	B Work-related expenses	2074.0	24.8	6.8
	C Real estate and interest cost	2755.3	33.0	9.0
	D Deductions related to assets and insurance	2056.6	24.6	6.7
	E Alimonies and charity	319.5	3.8	1.0
	F Other deductions	7.9	0.1	0.0
	<i>All deductions</i>	<i>8357.4</i>	<i>100.0</i>	<i>27.3</i>

Note: Deductions for 2001 are inflation adjusted based on the Swiss consumer price index (2001:92.4, 2011:100)

Table 2 shows that deductions decrease in gross income by almost 30%. This is a magnitude comparable to other countries<sup>7</sup>. By volume, real estate and interest costs are of most consequence,

<sup>7</sup> Verbist & Figari (2013) looked at 15 countries and reported a decrease of gross income by means of deductions within a range of 23% (Denmark) to 38% (France).

followed by work-related expenses and deductions related to assets and insurance. Slightly less important are social deductions, alimonies and charity. Compared to 2001, it can be seen that deductions related to assets and insurance were of greater importance in 2011. How deductions affect redistribution depends on the income groups benefitting. This issue is addressed in section 4.3.

### 3.3 Measuring redistribution effects

According to the OECD, the redistributive effect of taxes is defined as the change in income inequality achieved by applying taxes (OECD, 2008). How redistribution effects based on Lorence curve measures can be formally described, is shown below.

Reynolds & Smolensky (1977) describe the redistribution effect as the difference between the Gini coefficient before ( $G_x$ ) and after taxes ( $G_y$ ):

$$(1) RS = G_x - G_y$$

Positive values of RS represent a decrease of inequality via taxes, while negative values indicate an increase.

The redistributing effect of taxes depends on three factors: (a) the tax rate, (b) the progressivity of the tax and (c) horizontal effects of reranking (details follow below). By using Kakwanis (1977) index of progressivity K one can decompose the effect of (1) into the three components:

$$(2) RS = G_x - G_y = K * \frac{t}{1-t} - RR$$

The progressivity index  $K$  measures the disproportionality of taxes paid relative to pre-tax incomes and is defined as the difference between the concentration index of taxes ( $C_t$ ) and the Gini coefficient of the post-tax income distribution.  $C_t$  measures the inequality of taxes paid, when tax subjects are ranked by their pre-tax incomes. While a  $K$  of 0 indicates a proportionate tax, values between 0 and 1 indicate the degree of progressivity.<sup>8</sup> If no reranking occurs, formula (2) simplifies to (2):

$$(3) RS = K * \frac{t}{1-t} = VJ$$

The redistributing effect is therefore a direct function of progressivity and mean tax rate (Kakwani, 1977), the latter being a multiplier of progressivity.

Without effects of horizontal re-ranking, the effect of taxes is also interpreted as a measure of vertical justice (VJ) by Verbist & Figari (2013). This is a hypothetical measure, describing how much redistribution via taxes would be possible if there were no horizontal effects. In reality, however, it is common that some households switch positions in the income distribution when sorting is based on post-tax income instead of pre-tax income. I.e. households are treated unequally although their pre-tax constellation was similar. This might happen if different deductions were made or if taxes vary by region. Atkinson (1979) and Plotnick (1981) describe this reranking as the “horizontal inequity of the tax system”<sup>9</sup>. As these effects might indeed be intended, horizontal effects are not discussed in the

<sup>8</sup> The progressivity index ranges from -1 (person with lowest income pays all taxes) to 1 (person with highest income pays all taxes).

<sup>9</sup> Some authors distinguish between “pure horizontal inequity” and “unequal treatment of equals”. The latter includes unequal taxation for similar starting positions without switching ranks (see Lambert, 1993). It is, however, difficult to implement what is defined as financially “equal” (Urban & Lambert, 2008). The subsequent analyses were done without differentiating.



context of justice in this paper. Nonetheless, horizontal effects are reported, as they are important in the context of the effects of deductions. They are listed as horizontal effects of reranking (RR). These effects can be calculated as the difference between the Gini of post-tax incomes and the concentration index ( $C_x$ ) (Atkinson, 1980; Plotnick, 1981) :

$$(4) RR = G_y - C_x$$

According to formula (4), RR measures the increase of inequality (or reduction of the redistributive effect of taxes) caused by reranking. Estimation of the redistribution components was conducted with Stata's *progres* (Peichl & van Kerm, 2007).

### 3.4 Decomposition of redistribution effects

The redistribution effect described in formula (1) quantifies the effect of all taxes. The present study separates these effects for single types of taxes. Starting with the Reynolds & Smolensky redistribution effect (RS), the effect is then decomposed by a sequential approach which was already used in other studies (Mahler & Jesuit, 2006; Wang & Caminada, 2011; Wang et al., 2014). The method previously described is therefore used for each type of tax separately.<sup>10</sup> The effect of the  $i$ -th tax  $z$  is calculated as follows:

$$(5) RS_z = G_x - G_{x-t_i} = K_z * \frac{t_i}{1-t_i} - RR_{t_i}$$

<sup>10</sup> There are other methods of decomposition, e.g., the Lerman–Yitzhaki method (Lerman & Yitzhaki, 1985). Here, marginal effects of single income sources are determined simultaneously. Fuest, Niehues, & Peichl (2010) compare different decomposition methods used in the literature and conclude, that effects can indeed differ. This especially plays a role if the effects of social transfers are compared to the effects of taxes.

If multiple taxes are compared to each other, in which order to include which tax has to be determined. If a tax is used first in order, its partial effect tends to be largest, compared to being the last in order (usually the smallest effect). Here, the approach of Wang & Caminada (2011) and Wang et al. (2014) is followed. The effect of each tax is determined by using each tax as first tax<sup>11</sup>. Therefore, the sum of all effects is slightly higher than 100 percent (of the effect), so the effects are afterwards normalized to 100 percent by dividing by the sum of all effects.

The present study calculates the redistribution effect of different deductions ( $u_i$ ). Figure 2 shows that making deductions leads from gross income to taxable income, which is the base for calculating the different taxes (communal, cantonal and state). Deductions therefore have an indirect effect on the distribution of disposable incomes as they modify the tax rate applied. To determine effects, the tax system of the Canton of Aargau was replicated and income distributions were manufactured in a counterfactual fashion. The starting point is a distribution that would result if taxes were levied without any deductions being made beforehand. Next, the partial effect of a deduction is determined by simulating the income distribution after taxes using the  $i$ -th deduction and calculating the difference of Gini coefficients. As the first deduction usually yields the highest marginal tax relief, the effects are slightly overstated. Therefore, all effects are corrected to sum to 1, as previously described.

<sup>11</sup> Another approach would be to calculate all permutations of possible combinations of taxes and use the mean of all effects.

## 4 Redistributive effects within the tax system

Various studies have focused on the redistributive effects of social transfers and taxes in Switzerland. In comparative studies, Switzerland consistently appears as a country with a low redistributive impact of taxes and transfers (Immervoll & Richardson, 2011; Marx & Van Rie, 2014; Wang et al., 2014). This is usually explained with salaries being rather equal and employment being high. Therefore, market incomes are more equal and social expenditures are lower than in other countries<sup>12</sup>. Concerning the trend of redistribution, studies based on the Luxembourg Income Study (Immervoll & Richardson, 2011; Wang et al., 2014) find an increase of redistribution between 1985 and 2004, regardless whether or not pensioners are included. This finding is due to the effects of social transfers (e.g., pensions, unemployment benefits). At the same time, however, the effect of taxes decreased due to tax competition (Wang & Caminada, 2011; Feld, 2000; Kirchgässner & Pommerehne, 1996). In this context, Wang & Caminada (2011:272) note: “In this country it appears to be difficult to levy redistributive taxes from the rich and mobile persons to the poor. As a result, the amount of taxes paid by rich people is relatively low.”

Detailed effects of the tax system are, however, not well studied. In this section, tax data from the Canton of Aargau is used as an example to show how large the net redistributive effect is and how it changed from 2001 to 2011. Subsequently, the effect is then decomposed into the different effects of social transfers and taxes (see section 4.1). The effect of direct taxes is decomposed into six single components. As elaborated in section 0, the partial contributions of each income and wealth tax vary.

<sup>12</sup> There are some methodological aspects worth mentioning. According to Engler (2011), a substantial part of the redistribution is based on redistribution within the life cycle (e.g., pension schemes) and not attributable to redistribution between households. Christoffersen et al. (2014) further show that the amount of measured redistribution depends on what is or is not defined as a state service. As Switzerland organized multiple services in a private manner (pension scheme, health care), comparisons have to be treated with caution.

Finally, the effects of deductions are analyzed in detail, showing that some deductions benefit the poor while others benefit the rich; and, in sum, deductions hinder the redistributive effect of taxes (see section 4.3).

#### 4.1 Inequality and redistribution via social transfers and taxes

Table 3 shows inequality and redistributive effects calculated with tax data from the Canton of Aargau. In accordance with the definition of Reynolds–Smolensky, the effect is shown (a) as an absolute difference between the Gini coefficient of market incomes and the Gini coefficient of incomes after deductions and taxes, as well as (b) as the relative change of market income inequality. The lower half of the table shows the relative contributions of the different taxes and deductions.

Table 3: Inequality and redistributive effects of social transfers and taxes, 2001 and 2011

	2001	2011	2012 (CH)
Gini Market incomes (Aargau)	0.489	0.522	0.37
Gini disposable incomes (Aargau)	0.391	0.401	0.29
Net redistribution, Reynolds–Smolensky	0.098	0.121	0.08
Redistribution (in %), Reynolds–Smolensky	20.0%	23.1%	22.6%
<i>Partial effects</i>			
Social transfers			
abs.	0.076	0.100	
in %	77.6%	82.6%	
Direct taxes			
abs.	0.022	0.021	
in %	22.4%	17.4%	

*Note: The first two columns are based on individual tax data from Aargau (2001 and 2011). The last column is based on the OECD Dataset “Income Distribution and Poverty”. Own diagram.*

In comparison to the latest figures from the OECD (see right column in Table 3) one can see similarities and discrepancies. Based on tax data, inequality turns out to be higher for both market incomes as well as disposable incomes. There is also the question of whether analyses based on

Aargau data are representative for Switzerland. With respect to economic indicators, it can be cautiously assumed, that Aargau is within the Swiss middle range, giving a good approximation of the Swiss population. It is rather to be assumed, that the difference in table 4 stems from the data source. Tax data is superior to survey data – which the OECD figure is based on – as it covers the whole population, including high incomes which are often under-represented in survey data. The latter therefore underestimate inequality. However, one notable drawback of using tax data is, that the observation units are real households but tax units which leads to an overestimation of inequality (Hümbelin & Farys, 2016). The net redistributions, however, are similar in both data sources, being between 20% and 23.1% of market income inequality. Concerning the partial redistributive effects of social transfers and direct taxes, the results are comparable to those from other studies (Immervoll & Richardson, 2011; Wang & Caminada, 2011; Wang et al., 2014). The largest share of redistribution stems from social transfers, a minor share from direct taxes. It should be noted that the results are based on all age groups, i.e. pensions are part of the redistribution. At the same time, redistribution by social assistance cannot be depicted as these information are not included in tax data.

Concerning the partial redistributive effects of social transfers and direct taxes, the results are comparable to those from other studies (Immervoll & Richardson, 2011; Wang & Caminada, 2011; Wang et al., 2014). The largest share of redistribution comes from social contributions, a minor share from direct taxes. It should be noted that the results are based on all age groups, i.e. pensions are part of the redistribution. At the same time, redistribution by social assistance cannot be depicted as this information is not included in tax data.

Comparison over time shows that redistribution was more pronounced in 2011 than in 2001. The same is true for inequality. Redistributions rose mainly due to an increase of social transfers<sup>13</sup>. On the other hand, redistribution by direct taxes was smaller. This is the case for both the absolute amount and the share of the total effect. In sum, redistribution increased under-proportionally to the increase in market inequality, therefore resulting in a small increase in disposable income inequality. In contrast to the studies of Immervoll & Richardson (2011) and Wang et al. (2014), who find a decrease in income inequality for Switzerland based on the Luxembourg Income Study, the present study can't find a decreasing trend.

#### **4.2 Partial redistributive effects of taxes on income and wealth**

Table 4 shows how the net redistributive effect of taxes can be decomposed into partial effects of single taxes. Thus, one can identify which taxes contributed to the decreasing trend of redistribution. It can be seen that the decline is primarily due to the reduced tax burden of cantonal and communal taxes, while the effect of state taxes was stable. Therefore, the proportional significance of state taxes increased. Most apparent was the decline of the redistributive effect for communal taxes, which contributed one quarter of the total effect. For communal taxes, progression as well as the mean tax rate decreased. The results suggest that redistributive effects declined on the level where tax competition was most pronounced. While state tax is exposed to international tax competition, federal units in addition compete with other cantons or even with other communities within their canton.

<sup>13</sup> It is not possible to tell which benefits exactly caused the increase as pension benefits are reported as one joint figure. It can, however, be assumed that the increase is comprised of pensions from old-age provisions and that the result is an effect of demographic ageing. During the 10 years of the observation period the mean age increased by two years, while at the same time there was no known increase of unemployment benefits in the Canton of Aargau.

Table 4 : Partial redistributive effects of different taxes, 2001 and 2011

	2001		2011	
	Abs.	in %	Abs.	in %
<b>All taxes</b>				
Net redistrib. (Reynolds–Smolensky)	0.022	100.0	0.021	100.0
Progressivity index (Kakwani)	0.149	–	0.155	–
Horizontal reranking	0.0012	5.3	0.0010	4.7
Ø – tax burden	0.134	–	0.124	–
<b>Income tax, state</b>				
Net redistrib. (Reynolds–Smolensky)	0.008	35.4	0.008	38.7
Progressivity index (Kakwani)	0.336	–	0.355	–
Horizontal reranking	0.0000	0.1	0.0011	5.0
Ø – tax burden	0.021	–	0.021	–
<b>Income tax, canton</b>				
Net redistrib. (Reynolds–Smolensky)	0.006	28.5	0.006	28.0
Progressivity index (Kakwani)	0.115	–	0.118	–
Horizontal reranking	0.0001	0.5	0.0011	5.0
Ø – tax burden	0.049	–	0.046	–
<b>Wealth tax, canton</b>				
Net redistrib. (Reynolds–Smolensky)	0.001	3.4	0.001	3.1
Progressivity index (Kakwani)	0.141	–	0.144	–
Horizontal reranking	0.0000	0.2	0.0000	0.2
Ø – tax burden	0.005	–	0.004	–
<b>Income tax, community</b>				
Net redistrib. (Reynolds–Smolensky)	0.006	26.3	0.005	24.7
Progressivity index (Kakwani)	0.111	–	0.110	–
Horizontal reranking	0.0001	0.5	0.0001	0.4
Ø – tax burden	0.047	–	0.043	–
<b>Wealth tax, community</b>				
Net redistrib. (Reynolds–Smolensky)	0.001	3.0	0.001	2.7
Progressivity index (Kakwani)	0.132	–	0.134	–
Horizontal reranking	0.0000	0.2	0.0000	0.1
Ø – tax burden	0.005	–	0.004	–
<b>Church tax</b>				
Net redistrib. (Reynolds–Smolensky)	0.001	3.4	0.001	2.8
Progressivity index (Kakwani)	0.106	–	0.105	–
Horizontal reranking	0.0000	0.0	0.0000	0.0
Ø – tax burden	0.007	–	0.005	–

*Note:* Percentage values in the rows “Net redistrib. (Reynolds–Smolensky)” are the shares that each tax has relative to the total effect of redistribution. Percentage values in the reranking rows can be read as the potentially possible increase of redistribution if there wasn’t any reranking.

The table further indicates the significance and mechanism of the different taxes. Although the state tax makes up only 1/8 of the total tax burden (see Table 1), it accounts for more than one third of the total redistributive effect. According to the progressivity index, state tax is the most progressive tax. It is even more progressive than community and canton wealth taxes. Within the same federal level, however, wealth taxes are more progressive than income taxes. Yet the latter nevertheless contribute more to the net redistribution effect because their tax load is far bigger than that of the wealth taxes.

Finally, horizontal reranking effects quantify how much redistribution via taxes is lost due to reranking households with similar initial gross income. The value of 5.3% of all taxes means that redistribution could have been 5.3% higher if there was no loss due to reranking. Regarding the particular taxes, all reranking effects are rather small. For deductions, however, these effects are more pronounced.

#### **4.3 Partial redistributive effects of tax deductions**

How do deductions relate to redistributive effects? Table 5 shows detailed information on redistributive effects that result from tax deductions, broken down into six main categories. Because deductions redistribute income indirectly by modifying taxes, the redistributive effects of deductions are measured as the difference between tax effects with and without applying each deduction. Due to the scope of this paper, special allowances related to wealth tax have been left out and the focus has been solely on deductions for income taxes.



Table 5 : Partial redistributive effects of tax deductions

	2001		2011	
	Abs.	in %	Abs.	in %
<b>All deductions</b>				
Δ-Net redistrib. (Reynolds-Smolensky)	-0.021	-48.8	-0.016	-43.1
Δ-Progressivity index (Kakwani)	-0.005	-3.4	0.002	1.5
Δ-Horizontal reranking	0.0003	29.7	0.0000	4.7
Δ-Ø - tax burden	-0.087	-39.3	-0.074	-37.5
<b>A_Social deductions</b>				
Δ-Net redistrib. (Reynolds-Smolensky)	-0.002	-5.6	-0.002	-5.6
Δ-Progressivity index (Kakwani)	0.003	2.2	0.001	1.0
Horizontal reranking	0.0004	50.2	0.0003	30.8
Δ-Ø - tax burden	-0.021	-9.4	-0.010	-5.1
<b>B_Work-related expenses</b>				
Δ-Net redistrib. (Reynolds-Smolensky)	-0.001	-2.1	-0.001	-1.7
Δ-Progressivity index (Kakwani)	0.017	11.2	0.016	10.7
Horizontal reranking	0.0002	20.9	0.0000	3.6
Δ-Ø - tax burden	-0.021	-9.4	-0.018	-9.2
<b>C_Real estate and interest cost</b>				
Δ-Net redistrib. (Reynolds-Smolensky)	-0.014	-33.0	-0.009	-25.2
Δ-Progressivity index (Kakwani)	-0.030	-19.5	-0.019	-12.5
Horizontal reranking	0.0002	18.0	0.0000	0.9
Δ-Ø - tax burden	-0.036	-16.5	-0.028	-14.0
<b>D_Deductions related to assets and insurance</b>				
Δ-Net redistrib. (Reynolds-Smolensky)	-0.003	-6.9	-0.003	-8.8
Δ-Progressivity index (Kakwani)	0.006	3.6	0.004	2.5
Horizontal reranking	0.0000	0.1	0.0000	-4.6
Δ-Ø - tax burden	-0.019	-8.6	-0.019	-9.7
<b>E_Alimonies and charity</b>				
Δ-Net redistrib. (Reynolds-Smolensky)	-0.001	-1.2	-0.001	-1.7
Δ-Progressivity index (Kakwani)	0.001	0.4	0.000	0.1
Horizontal reranking	0.0000	3.1	0.0000	1.6
Δ-Ø - tax burden	-0.003	-1.3	-0.003	-1.6
<b>F_Other deductions</b>				
Δ-Net redistrib. (Reynolds-Smolensky)	0.000	-0.1	0.000	0.0
Δ-Progressivity index (Kakwani)	0.000	0.0	0.000	0.0
Horizontal reranking	0.0000	-0.1	0.0000	0.2
Δ-Ø - tax burden	0.000	-0.1	0.000	0.0

*Note: Redistributive effects are defined as the difference ( $\Delta$ ) between the taxes redistributive effect before and after applying the  $i$ -th deduction. Percentage values are the share of the difference in relation to the effect without deductions. Initial values are listed in Table 11 and Table 12 in the appendix.*

In sum, all deductions reduce the redistributive impact of taxes tremendously by –48.8% (2001) and –43.1% (2011). The progressivity index, however, is thereby only slightly modified. In 2001, deductions led to a reduction of progressivity, while in 2011 deductions resulted in a slight increase. More importantly, deductions impact the tax burden by lowering the tax rate according to formula (5), where it is visible that the tax rate acts as a multiplier of progressivity. In sum, deductions led to a tax relief of 39.3% (2001) and 37.5% (2011), respectively.

Detailed analysis of each category of deductions further shows that redistributive effects vary substantially. The biggest contribution to lowering the redistributive effect results from deductions related to real estate and interest costs. It is not possible on the basis of the data to identify the kind of interest, but it can be assumed that for the most part these are mortgage interests. Comparing 2001 and 2011 it becomes apparent that this effect of real estate expenses and interest costs decreased considerably. This change is the greatest change over time and can be explained with the ongoing decrease of the mortgage reference interest rate, which was 4.25% in 2001 and 2.5% in 2011<sup>14</sup>, thus leading to lower interest on debt. As a result, less interest costs had to be paid, and correspondingly less deductions were possible in 2011. Another important impact on the redistributive effect comes from deductions of costs related to assets and insurance. In particular, deductions of extra-mandatory payments to the pension scheme lowers the redistributive effect. This category, moreover, gained significance over time, probably due to demographic ageing.

Deductions of work-related expenses are, in terms of volume, the second most important category. Although work-related expenses lead to an increase in progressivity (discussed later), the redistributive effect of income taxes is still reduced because the tax relief this causes outweighs the

<sup>14</sup> <http://www.mietrecht.ch/20.0.html> (viewed July 26, 2016)

higher progression. Even social deductions reduce redistribution by taxes. At the same time, social deductions caused substantial reranking effects, of 50% (2001) and 31% (2011), respectively.

Therefore, social deductions are the biggest promoter of inequality between households with similar initial financial situations.

Figure 1 : Mean amount of deductions (left column) and resulting relative tax relief (right column) by quintiles of gross income, 2011



*Note:* The mean tax saving is defined as the share of tax reduction in relation to the hypothetical tax burden without deduction.

Finally, it can be said that all deductions diminish the effect of redistribution via income taxes, although some increase the progressivity. This is particularly striking if effects of work-related expenses and those related to real estate and interest costs are compared. Figure 1 visualizes the change in progressivity broken down by quintiles. For this purpose, the stata-Ado pshare was used (Jann, 2016), which allows a straightforward representation of percentile shares using histograms. For

each quintile the figure shows the average amount of deduction (left column) and the resulting tax relief (right column) as the share of tax reduction compared to a counterfactual situation without deductions. As can be seen from the figure, high income filers can claim higher amounts of deductions. However, their income is also much higher. The effect of progression can be more easily seen if relative tax relief is viewed. Taken as a whole, deductions have the highest impact in the lowest quintile. The least profiting income groups are the second and third quintile or, put simply, the middle class. In sum, the progression increases, but the overall effect still decreases as previously described. More explicit – in terms of benefit for the particular quintiles – is the development of tax relief for work-related expenses (progression increases) and real estate expenses (progression decreases). Work-related expenses lead only to a slight reduction of the redistributive effect, while deductions on real estate and interest costs impact redistribution substantially.

The time trend of decreasing redistribution by taxes, it can be said, is not a consequence of deductions. On the contrary, the limiting effect of deductions to redistribute income decreased over time. This can be explained by declining interest rates, thus leading to lower real estate and interest costs.

## 5 Discussion

Using administrative individual tax data, this paper investigated the changing role of the tax system for redistribution. Based on the example case of the Swiss canton Aargau, it is examined, how the redistributive effect of direct income and wealth taxes changed between 2001 and 2011. The contribution of the paper is threefold. First, tax data allows for detailed analyses of the effects of particular taxes. Switzerland is an especially interesting field to investigate the effects of the tax

system – especially effects of tax competition, as it is organized in a decentralized manner, taxing on different federal levels (state, canton and community). Second, the present study provides detailed analyses of redistributive effects that stem from tax deductions. Deductions can help meet social goals, e.g. by benefitting families or ill persons or providing incentives for financially desirable behavior like saving for old age. Sometimes, deductions are also a mere hotchpotch of special interests that grew over years. The effect of deductions on redistribution is therefore hard to predict and the present study disclosed these effects for the first time. Third, the study serves to complement analyses based on survey data (which dominate the inequality literature), in order to verify if the trends that are found by means of survey data are indeed real. This is important because survey data is affected by sample bias, potentially leading to wrong conclusions in the context of inequality research, while tax data covers the whole population and is therefore not biased by the sampling process.

Methodologically, the study uses a Gini-based sequential decomposition, beginning with a Reynolds–Smolensky (net) redistribution effect, which is calculated as the difference between Gini coefficients of market incomes before and after taxation. The effect is decomposed into three parts: (a) the progression, (b) the mean tax burden, which acts as a multiplier for progression, and (c) horizontal effects of reranking, which occur if households with similar financial situations – before taxation – switch places in the income distribution after taxes were paid. This side effect mitigates the potential degree of redistribution by taxes, but is hard to circumvent in conjunction with deductions. Our approach further allows us to determine each single tax's and deduction's contribution to the total effect, revealing the importance of each instrument in the process of taxation and redistribution.

The increase of inequality is ultimately attributable to a decrease of tax effectiveness. Decomposition of the net effect into single components of the taxes on income and wealth by the state, cantons and communities shows that the redistributive effect of taxes diminished the most at the lowest federal level: the communities. The effectiveness of cantonal taxes also decreased. Tax reforms in the 2000s over-proportionally disburdened high income filers. The redistributive effect of direct state tax, however, remained constant during the ten years of observation. This suggests that tax competition puts the most pressure on communities, i.e. the smallest federal units.

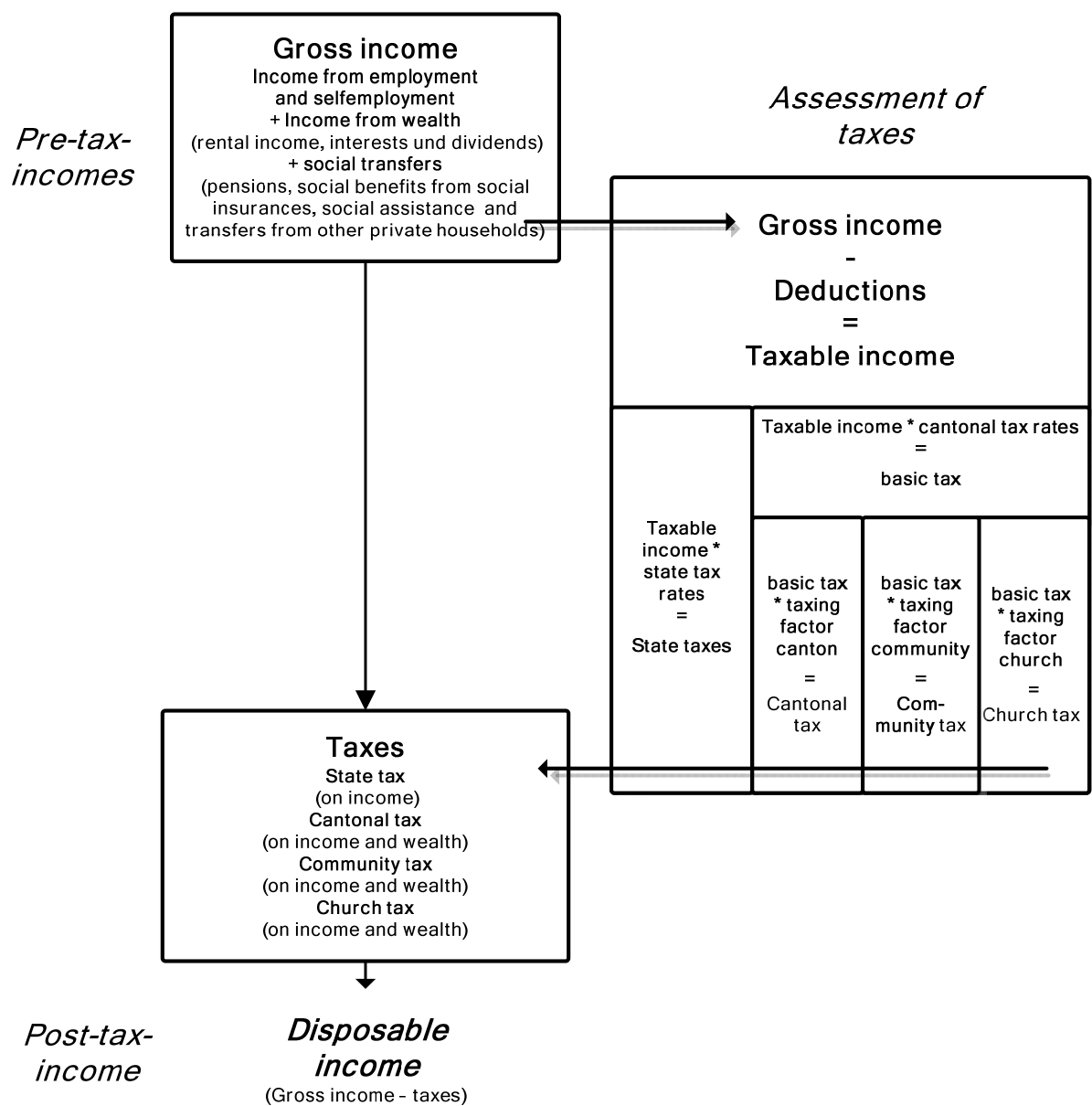
Tax deductions, on the other hand, did not contribute to the trend of less redistribution. While deductions reduce the redistributive effect of taxes substantially (by –48.8% in 2001 and –43.1% in 2011) by lowering the tax rate, some deductions favor high income filers; most importantly, deductions based on real estate and interest costs. Since interest rates decreased over the last decade, fewer deductions were possible, thus leading to a less pronounced reduction of the taxes' redistributive effect. In the end, social deductions can be identified as the deductions with the strongest reranking effect.

Regarding the question whether inequality trends between 2001 and 2011 for disposable incomes from tax data match the trend found in survey data, this study comes to a different conclusion. The income gap between poor and rich has widened. As Aargau is the fourth-largest canton and resembles the socio-economic structure of Switzerland, it can be assumed that Aargau is not an exception. Rather, the result is explained by the quality of data, as tax data captures changes at the tail ends of the income distribution, while survey data misses a lot of this information to sampling bias. However, because tax subjects are not necessarily households – households being the preferred

statistical unit of analysis – it cannot be fully ruled out that the inequality trend is an artefact of a change in the fiscal household constellation (e.g., a trend not to marry).

## 6 Appendix

Figure 2: From gross income to disposable income and the tax assessment



Soure: Own diagram



Table 6: Marginal tax rate of cantons, communities and church in percent of gross income for unmarried individual living in Aarau (capitol of the Canton of Aargau)

	2001	2011	$\Delta$ Percent
Low incomes (0 to 35'000 CHF)	3.0	1.2	1.9
Middle incomes (35'001 – 60'000 CHF)	8.9	7.6	1.3
High incomes (60'001 – 125'000 CHF)	14.5	12.6	1.9
Very high incomes (125'001 – 1'000'000 CHF)	21.7	17.9	3.8

Source: Tax burden in canton capital cities, Eidgenössische Steuerverwaltung, mean burden for reported income groups

Table 7: Marginal tax rate of cantons, communities and church in percent of gross income for married with two children living in Aarau (capitol of the Canton of Aargau)

	2001	2011	$\Delta$ Percent
Low incomes (0 to 35'000 CHF)	0.2	0.0	0.2
Middle incomes (35'001 – 60'000 CHF)	1.6	1.2	0.4
High incomes (60'001 – 125'000 CHF)	6.5	5.9	0.6
Very high incomes (125'001 – 1'000'000 CHF)	18.4	14.5	3.9

Source: Tax burden in canton capital cities, Eidgenössische Steuerverwaltung, mean burden for reported income groups

Table 8: Assignment of deductions to main categories

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**A Social deductions**

- A1 Second earner deduction
- A2 Special deductions for second earners when assisting in own business
- A3 Costs of illness or disability
- A4 Child deductions
- A5 Deductions for supported persons
- A6 Invalidity deduction
- A7 Deductions for child care
- A8 Deductions for paid out life annuities

**B Work-related expenses**

- B1 Miscellaneous work expenses individual/spouse
- B2 Child care necessary for job

**C Real estate and interest costs**

- C1 Property expenses
- C2 Debt interest

**D Deductions related to assets and insurance**

- D1 Cost of asset management
- D2 Buying into obligatory pension scheme (Pillar 2), individual/spouse
- D3 Contribution to voluntary pension scheme (Pillar 3a)
- D4 Personal premiums to social security (AHV/IV)
- D5 Insurance cost and interest of savings capital

**E Alimonies and charity (transfers)**

- E1 Alimonies to spouse
- E2 Alimonies to children
- E3 Party donations
- E4 Voluntary contributions

**F Other deductions**

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Table 9: Redistributive effects of income and wealth taxes of direct state, canton, community and church tax, Aargau 2001

	Pre-tax Gini	Post-tax Gini	Mean tax burden	Reynolds- Smolensky net redist.	Kakwani progressivity index	Vertical equity	Reranking
Taxes (Total)	0.4131	0.3912	0.1336	0.0219	0.1495	0.0231	0.0012
State	0.4131	0.4059	0.0210	0.0072	0.3360	0.0072	0.0000
Canton							
(inc.+prop.)	0.4131	0.4066	0.0539	0.0065	0.1174	0.0067	0.0002
Canton-income	0.4131	0.4073	0.0488	0.0058	0.1149	0.0059	0.0001
Canton-prop.	0.4131	0.4124	0.0051	0.0007	0.1414	0.0007	0.0000
Comm.							
(Inc.+prop.)	0.4131	0.4071	0.0515	0.0060	0.1134	0.0062	0.0002
Comm.-income	0.4131	0.4078	0.0467	0.0054	0.1114	0.0055	0.0001
Comm.-wealth	0.4131	0.4125	0.0048	0.0006	0.1322	0.0006	0.0000
Church	0.4131	0.4124	0.0066	0.0007	0.1060	0.0007	0.0000

Non-normalized effects

Table 10: Redistributive effects of income and wealth taxes of direct state, canton, community and church tax, Aargau 2011

	Pre-tax Gini	Post-tax Gini	Mean tax burden	Reynolds- Smolensky net redist.	Kakwani progressivity index	Vertical equity	Reranking
Taxes (Total)	0.4221	0.4011	0.1242	0.0210	0.1549	0.0220	0.0010
State	0.4221	0.4145	0.0211	0.0076	0.3552	0.0077	0.0001
Canton							
(inc.+prop.)	0.4221	0.4160	0.0504	0.0061	0.1177	0.0062	0.0001
Canton- income	0.4221	0.4166	0.0460	0.0055	0.1151	0.0056	0.0001
Canton-prop.	0.4221	0.4215	0.0044	0.0006	0.1443	0.0006	0.0000
Comm.							
(Inc.+prop.)	0.4221	0.4167	0.0470	0.0054	0.1117	0.0055	0.0001
Comm.- income	0.4221	0.4173	0.0429	0.0048	0.1096	0.0049	0.0001
Comm.-wealth	0.4221	0.4216	0.0041	0.0005	0.1340	0.0005	0.0000
Church	0.4221	0.4216	0.0053	0.0006	0.1051	0.0006	0.0000

Non-normalized effects

Table 11: Redistributive effects of tax deductions, Aargau 2001

	Pre-tax Gini	Post-tax Gini	Mean tax burden	Reynolds- Smolensky net redistrib.	Kakwani progressivity index	Vertical equity	Reranking
Excl. deductions	0.4131	0.3703	0.2201	0.0428	0.1548	0.0437	0.0009
Incl. deductions (real)	0.4131	0.3912	0.1336	0.0219	0.1495	0.0231	0.0012
A_Social deductions	0.4131	0.3730	0.2077	0.0401	0.1582	0.0415	0.0013
B_Work-related	0.4131	0.3713	0.1995	0.0418	0.1721	0.0429	0.0011
C_Real estate	0.4131	0.3861	0.1839	0.0270	0.1245	0.0280	0.0011
D_Financial	0.4131	0.3736	0.2013	0.0395	0.1603	0.0404	0.0009
E_Transfers	0.4131	0.3709	0.2173	0.0422	0.1553	0.0431	0.0009
F_Others	0.4131	0.3704	0.2200	0.0427	0.1547	0.0436	0.0009

Non-normalized effects

Table 12: Redistributive effects of tax deductions, Aargau 2011

	Pre-tax Gini	Post-tax Gini	Mean tax burden	Reynolds- Smolensky net redistrib.	Kakwani progressivity index	Vertical equity	Reranking
Excl. deductions	0.4221	0.3852	0.1987	0.0369	0.1525	0.0378	0.0009
Incl. deductions (real)	0.4221	0.4011	0.1242	0.0210	0.1549	0.0220	0.0010
A_Social deductions	0.4221	0.3875	0.1886	0.0346	0.1540	0.0358	0.0012
B_Work-related	0.4221	0.3859	0.1804	0.0362	0.1688	0.0372	0.0010
C_Real estate	0.4221	0.3956	0.1708	0.0265	0.1335	0.0275	0.0010
D_Financial	0.4221	0.3888	0.1794	0.0333	0.1563	0.0342	0.0009
E_Transfers	0.4221	0.3859	0.1956	0.0362	0.1527	0.0371	0.0010
F_Others	0.4221	0.3852	0.1986	0.0369	0.1525	0.0378	0.0009

Non-normalized effects

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